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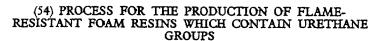
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(71) We, BAYER AKTIENGESELLSCHAFT a body corporate organised under the laws of Germany of 509 Leverkusen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Urethane group-containing foam resins obtained by reacting polyisocyanates with polyols which contain active hydrogen atoms are widely used, e.g. in the field of insulation, for the manufacture of structural elements or for upholstery padding. The possible applications of polyurethane foams are, however, restricted by their inflammability at high temperatures and/or in the presence of fire.

It is known to produce urethane group-containing foam resins which have flame resistant properties from compounds which contain active hydrogen atoms, preferably polyols, polyisocyanates, water and/or other blowing agents in the presence of emulsifiers, auxiliary agents and catalysts as well as flame retarding additives. The function of the emulsifiers and stabilizers in the reaction mixture is to homogenize the reactants and, at the same time, to facilitate the foaming process and prevent collapse of the foam after the cessation of gas formation. The catalysts are intended to ensure that the processes taking place during formation of the foam are brought into the required equilibrium and take place at the correct velocity. A certain non-inflammability can be achieved by first adding to the starting components foaming agents which reduce the flammability of the foam. Substances which have been used for rendering foams non-flammable are compounds of phosphorus, halogens, antimony, bismuth and boron and, also, to a certain extent, nitrogen compounds. Flame-retarding additives may be subdivided into those which are built into the foam structure by their functional groups and those which, due to the absence of such groups, are merely loosely incorporated and act more as plasticizers or fillers (see Chapter 2, 3 and 10 "Flammhemmende Substanzen", Kunststoff-Handbuch, Vieweg-Höchtlen Volume XII, Polyurethane, Carl Hanser-Verlag, Mmich, 1969).

The introduction of such flame retarding compounds into urethane-group-containing resins which have a low density and large surface area frequently results in a loss of desirable physical properties such as high tensile strength, shape permanence, stretchability and bearing capacity and therefore restricts the application of such foams. For example, although the introduction of a hygroscopic flame-retarding additive to a polyurethane foam reduces its flammability, it also increases its moisture absorption and therefore results in poor age-resistance properties. The application of flame-retarding additives may also result in a steep increase in internal cell structures, formation of coarse cell structure and/or collapse of the foam. Effective fire-proofing of polyurethane foams, in contrast to the fire-proofing of compact poly-



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urethanes, is difficult because the desired distribution of the additive at the gas/solid interfaces is impossible to achieve owing to the composition of the foaming mixture. It should also be pointed out here that the effective fireproofing of a polyurethane foam is not a simple function of the addition of various fireproofing agents.

Flame-resistant urethane group-containing foam resins with the desired physical properties may be produced e.g. from polyethers which contain active hydrogen atoms and in which at least 10% of the hydroxyl groups present are primary hydroxyl groups and which have a molecular weight of e.g. 750 to 10,000, preferably 4000 to 8000, and special polyisocyanates.

The special polyisocyanates required for this purpose are for example the so-called modified polyisocyanates, e.g. solutions of polyisocyanates which contain biuret groups in polyisocyanates which are free from biuret groups and/or solutions of polyisocyanates which contain at least two NCO groups and at least one N,N'-disubstituted allophanic acid ester group in polyisocyanates which are free from allophanic acid ester groups and/or solutions of reaction products of diisocyanates and divalent or higher-valent compounds which contain hydroxyl groups in polyisocyanates which are free from urethane groups and/or solutions of polyisocyanates which contain one NCO group and at least one isocyanuric acid ring in polyisocyanates which are free from isocyanurate groups. High flame resistance in foam resins which contain urethane groups means that they are graded as self-extinguishing according to ASTM Method D 1692-67 T.

Flame-resistant urethane group-containing foam resins with the desired physical properties which have been produced e.g. using the modified polyisocyanates have the disadvantage of having faults in the form of bubbles under the surface of the foam, which may also extend to the interior of the foam. These faults occur especially in moulded foam products produced by the process of foaming in the mould and they are a very serious disadvantage, e.g. in the manufacture of moulded parts used for the furniture industry or motor car industry because these bubbles are very clearly visible through fine quality covering materials.

It has been found that attempts to overcome this defect by using commercial polysiloxane-polyalkylene oxide copolymers do not give the desired result because the addition of even a small quantity of stabilizer results in irreversible shrinkage of the foam so that the foam becomes unusable.

According to the invention, a process for the production of non-shrinking flameresistant foam resins which contain urethane groups has been found which is based on the use of certain siloxanes for preventing the undesirable formation of bubbles in the interior of the foam and under the surface.

This invention thus relates to a process for the production of non-flammable, non-shrinking open-celled foam resins which contain urethane groups from polyethers which contain active hydrogen atoms and preferably have a molecular weight of 750 to 10,000, polyisocyanates, water and/or organic blowing agents in the presence of silicon compounds, in which the silicon compounds are siloxanes of the following general formula

$$R_3-SiO-\begin{bmatrix} R^1\\ -Si-O-\\ 0\\ SiR_3\end{bmatrix}_{\underline{\sigma}} -Si-R_3$$

preferably used in quantities of 0.1 to 25% by weight, more preferably 0.20 to 5% by weight, based on the weight of polyisocyanate and of polyether. In the above formula, R represents an aliphatic hydrocarbon radical preferably containing less than 3 carbon atoms, preferably methyl, R' represents a monovalent aromatic radical, preferably phenyl, and a represents values of from 0 to 3; at least 70% by weight of the siloxane mixture consisting of siloxanes in which a=1 and siloxanes in which a=0 and a=2 or a=3 are present in the mixture in proportions of not more than 25% by weight, 20% by weight and 5% by weight, respectively.

The following technical advantages have surprisingly been found.

1. The siloxanes used according to the invention are substances which can be

| 5 | thoroughly and rapidly mixed with the polyethers mentioned above and the other foam components. Rapid and vigorous mixing of the components brings considerable advantages, namely the fluidity of the reaction mixture and the formation of nuclei during the foaming process are greatly promoted, factors which are the precondition | |
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| , | for optimum manufacturing results in the production of foams by a moulding process involving long flow paths or widely varying cross-sections, and, moreover, the stability of the reaction mixture is improved and, after completion of the foaming process, a fine cell structure is obtained right up to the surface of the foam in cases where foams are produced by a moulding process. | 5 |
| 10 | 2. Highly elastic mouldings with an exceptionally good handle can be obtained using the conventional foaming conditions and foam formulations, which means that the compression characteristic is advantageously improved. 3. The siloxanes used according to the invention do not impair the efficiency of | 10 |
| 15 | agents used for obtaining an open cell structure, which agents may be either loosely incorporated or built in chemically and can be uniformly distributed throughout the whole substance. 4. When used in the conventional foam formulations under conventional operating conditions, siloxanes according to the invention result in foams with a high flame | 15 |
| 20 | resistance, which means that according to ASTM D 1692-67 T they are graded as self-extinguishing and in this respect they differ from the polysiloxane-polyalkylene oxide copolymers conventionally used which result in foams which are assessed as flammable according to ASTM D 1692-67 T. | 20 |
| 25 | The starting components used for carrying out the process according to the invention may be known aliphatic, cycloaliphatic, araliphatic or aromatic polyisocyanates, for example tetramethylene-1,4-diisocyanate; hexamethylene - 1,6 - diisocyanate; dodecane-1,12-diisocyanate; cyclohexane-1,3- and -1,4-diisocyanate and any mixtures of these isomers; 1 - isocyanato - 3,3,5 - trimethyl - 5 - isocyanatomethyl - cyclohexane; phenylene - 1,3 - and - 1,4 - diisocyanate; tolylene - 2,4 - and - 2,6 - diiso- | 25 |
| 30 | cyanate and any mixtures of these isomers; hexahydrotolylene-2,4- and -2,6-diisocyanate and any mixtures of these isomers; diphenylmethane-4,4'-diisocyanate; naphthylene-1,5-diisocyanate; triphenylmethane-4,4',4''-triisocyanate; polyphenyl-polymethylene polyisocyanates produced by the phosgenation of aniline-formaldehyde condensation products; polyisocyanates containing carbodiimide-isocyanate adducts ob- | 30 |
| 35 | tained according to German Patent Specification No. 1,092,007; the diisocyanates described in U.S. Patent Specification No. 3,492,330; polyisocyanates containing allophanate groups as described in British Patent Specification No. 994,890; Belgian Patent Specification No. 761,626 and published Dutch Patent Application No. 7,102,524; polyisocyanates with isocyanurate groups as described in German Patent | 35 |
| 40 | Specifications Nos. 1,022,789 and 1,027,394 and in German Offenlegungsschriften Nos. 1,929,034 and 2,004,048; polyisocyanates containing biuret groups as described in German Patent Specification No. 1,101,394; British Patent Specification No. 889,050 and French Patent Specification No. 7,017,514; polyisocyanates prepared by telomerisation reactions as described in Belgian Patent Specification No. 723,640; | 40 |
| 45 | polyisocyanates containing ester groups in accordance with British Patent Specifications Nos. 956,474 and 1,072,956; aliphatic, cycloaliphatic, araliphatic or aromatic polyisocyanates mentioned by W. Siefgen in Justus Liebig's Annalen der Chemie, 562, pages 75 to 136; reaction products of the above mentioned isocyanates with acetals in accordance with German Patent Specification No. 1,072,385 and the isocyanates men- | 45 _. |
| 50 | tioned in German Patent Specifications Nos. 1,022,789 and 1,027,394. Any mixtures of the above mentioned polyisocyanates may, of course, also be used. It is generally preferred to use commercially readily available polyisocyanates, | . 50 |
| 55 | e.g. tolylene-2,4- and -2,6-diisocyanate and any mixtures of these isomers as well as polyphenyl-polymethylene-polyisocyanate which may be produced by the phosgenation of aniline-formaldehyde condensation products. According to the invention, it is also preferred to use polyisocyanates which are solutions of so-called modified polyisocyanates, i.e. solutions of polyisocyanates containing biuret, allophanate, urethane or isocyanurate groups in polyisocyanates which | 55 |
| 60 | per se. The solutions of modified polyisocyanates which are preferred for the invention generally contain 5 to 85% by weight and preferably 10 to 50% by weight of modified polyisocyanate. The unmodified polyisocyanates used are mainly tolylene-2,4-and/or -2,6-diisocyanate, which may be mixed with diphenyl-methane-4,4'-diiso- | 60 |
| 65 | cyanate and its isomers. Preparation of allophanate polyisocyanates may be carried out e.g. according to | 65 |

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Belgian Patent Specification No. 763,529, preferably using diisocyanates such as tolylene-2,4-diisocyanate or mixtures thereof with tolylene-2,6-diisocyanate. The polyisocyanate solutions used according to the invention generally contain 5 to 85% by weight, more preferably 10 to 50% by weight, of allophanate polyisocyanate.

The modified polyisocyanates used according to the invention may also be solutions of polyisocyanates which contain biuret groups in polyisocyanates which are free from biuret groups. It is preferred to use 5 to 85% by weight solutions of biuret group-containing polyisocyanates of the following general formula:

in which R represents a preferably C₁ to C₁₀ alkylene radical, preferably C₂ to C₁₀ cycloalkylene radical, preferably C₇ to C₁₂ aralkylene radical or preferably C₆ to C₁₀ arylene radical and X represents hydrogen or the group

$$X = -(--CO - N -)_n - H$$
 $|$
 $R - NCO$

in which R has the meaning specified above and n represents 0 or an integer prefer-15 ably 0 or an integer of from 1 to 5 in polyisocyanates which are free from biuret groups, the proportion of biuret polyisocyanates which contain more than 3 isocyanate groups, based on the total quantity of polybiuret isocyanates, preferably being at least 20% by weight. Preparation of polyisocyanates which contain biuret groups may be carried out e.g. according to British Patent Specification No. 889,050 or German Patent Specification No. 1,101,394. Preferred polyisocyanates according to the inven-20 tion are solutions of biuret polyisocyanates which have been prepared by reacting tolylene-2,4- and/or -2,6-diisocyanate, diphenyl methane-4,4'-diisocyanate and/or its isomers or a polyisocyanate mixture produced by the phosgenation of aniline-formaldehyde condensation products with water or formic acid in polyisocyanates which are free from biuret groups. The polyisocyanates used according to the invention preferably contain 0.03 to 5% by weight, more particularly 0.1 to 2% by weight, of chemically bound emulsifiers. These emulsifiers should contain hydroxyl, amino, 25 amido, H-COOH, -SH or urethane groups and are therefore incorporated in the polyisocyanate by reaction with the isocyanate groups in accordance with German 30 Offenlegungsschrift No. 1,963,189.

The isocyanate components used as starting material according to the invention may also be polyisocyanates which contain urethane group-containing polyisocyanates and which may be more highly branched than pure diffunctional isocyanates. The isocyanates used according to the invention preferably contain 5 to 85%, more preferably 10 to 50%, of urethane group-containing isocyanates dissolved in polyisocyanates which are free from urethane groups.

Modified polyisocyanates preferably used as starting material may also be solutions of polyisocyanates which contain at least one isocyanuric acid ring in liquid polyisocyanates which are free from isocyanurate groups. Such isocyanurate group-containing polyisocyanates and processes for preparing them have been described e.g. in German Patent Specification No. 951,168 and 1,022,789; British Patent Specifications No. 821,158; 827,120; 856,372; 927,173; 920,080 and 952,931; U.S. Patent Specifications No. 3,154,522 and 2,801,244; French Patent Specification No. 1,510,342 and Belgian Patent Specification No. 718,994. The polyisocyanates which contain at least one isocyanuric acid ring are preferably polymeric tolylene diisocyanates, 2,4- or 2,6-isomers or any mixtures of these isomers, which may be mixed with 4,4'-diphenylmethane-diisocyanate or its isomers. The isocyanates used according to the invention are obtained by dissolving the polyisocyanate which contains isocyanurate groups, generally in quantities of 5 to 85% by weight based on the weight of the resulting polyisocyanate solutions, in the liquid polyisocyanates which are free from isocyanurate groups.

The polyisocyanates which are free from urethane groups, allophanate groups, isocyanurate, groups or biuret groups may be aliphatic, cycloaliphatic, aromatic or

| ٠ | araliphatic polyisocyanates, e.g. those described in Liebigs Annalen der Chemie, Volume 562 (1949), page 775 et seq. It is preferred to use tolylene-2,4- and/or -2,6,-diisocyanate or undistilled crude mixtures of these isomers, diphenyl-methane- | |
|----|--|----|
| 5 | 4,4'- and/or -2,4'-diisocyanate or the undistilled crude mixtures, naphthalene-1,5-diisocyanate, triphenyl-methane-4,4',4''-triisocyanate, 1 - isocyanato - 3,3,5 - trimethyl - 5 - isocyanatomethyl - cyclohexane, polyphenyl-polymethylene polyisocyanates produced by the phosgenation of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation products of aniline and/or alkyl-mixtured actions of the condensation actions of the condensation products of the condensation prod | 5 |
| 10 | substituted anilines with formaldehyde or isocyanates which contain carbodiimide-isocyanate adducts as described e.g. in German Patent Specification No. 1,092,007. Monofunctional isocyanates such as propylisocyanate, cyclohexylisocyanate, phenylisocyanate, tolylisocyanates or p-chlorophenylisocyanate may also be included but they should not amount to more than 20% of the isocyanate combination used | 10 |
| 15 | according to the invention, based on the total isocyanate content. Polyethers which contain at least two active hydrogen atoms and generally have a molecular weight of 750 to 10,000 and in which preferably at least 10% of the hydroxyl groups present are primary OH groups are also used as starting material | 15 |
| 20 | for the process of the invention. These polyethers may be obtained e.g. by reacting compounds which contain reactive hydrogen atoms, e.g. polyalcohols, with alkylene oxides such as ethylene oxide, propylene oxide, butylene oxide, styrene oxide or epichlorohydrin, which may be followed by modification of the resulting polyethers with ethylene oxide. | 20 |
| 25 | Suitable polyalcohols and phenols are e.g. ethylene glycol, diethylene glycol, polyethylene glycol, propane-1,2-diol, propane-1,3-diol, butane-1,4-diol, hexane-1,6-diol, decane-1,10-diol, butyne-2-diol-1,4-glycerol, butane-2,4-diol, hexane-1,3,6-triol, trimethylolpropane, resorcinol, di-tertbutyl-pyrocatechol, 3-hydroxy-2-naphthol, 6.7- | 25 |
| | di-hydroxyl-1-naphthol, 2,5-dihydroxy-1-naphthol, 2,2-(p-hydroxyphenyl)-propane, 4-(p-hydroxyphenyl)-methane, tris-(hydroxyphenyl alkanes such as tri-(hydroxyphenyl)-methane or tris-(hydroxyphenyl)-propane. Other suitable polyethers are: Adducts of 1,2-alkylene oxides with aliphatic or aromatic monoamines or polyamines, e.g. | |
| 30 | ammonia, methylamine, ethylene diamine, tetra- or hexa-methylene diamine, diethylene triamine, ethanolamine, diethanolamine, methyl-diethanolamine, triethanolamine, aminoethylpiperazine, toluidine, orto-, meta- and para-phenylene diamine, 2,4- and 2,6-diaminotoluene, 2,6-diamino-p-xylene, multi-nuclear and condensed aromatic polyamines such as 1,4-naphthylene-diamine and 4,4'-diamino-azobenzene. Resinous | 30 |
| 35 | materials of the phenol or resol type may also be used as starting materials. All these polyethers are preferably prepared with the addition of ethylene oxide. They may also be modified by reaction with less than equivalent quantities of polyisocyanate. | 35 |
| 40 | The higher molecular weight polyethers used according to the invention may also be used in admixture with low molecular weight compounds (molecular weight up to 750) which contain active hydrogen atoms or in admixture (up to 50% by weight based on the polyether) with other higher molecular weight compounds which con- | 40 |
| 45 | tain active hydrogen atoms. Suitable low molecular weight compounds with active hydrogen atoms are mainly compounds which contain hydroxyl groups, e.g. ethylene glycol, 1,3-butylene glycol, 1,4-butylene glycol, glycerol, trimethylolpropane, castor oil or adducts (molecular weight generally 200 to 750) of alkylene oxides such as ethylene oxide, propylene oxide or butylene oxide with such low molecular weight compounds which contain active hydrogen atoms or with water. Other suitable higher | 45 |
| 50 | molecular weight compounds with active hydrogen atoms are known compounds such as polyesters, polyacetals, polyester amides or polycarbonates. These may be used in proportions of up to 50% by weight, based on the polyether. The self-extinguishing polyurethane foams may be produced either by the pre- | 50 |
| 55 | polymer process or, preferably, by the known one-shot process. In the one-shot process, the foam is produced at room temperature and/or elevated temperature by simply mixing the polyisocyanates with the polyethers, using water and/or other blowing agents, to which emulsifiers and other auxiliary agents as well as the siloxanes according to the invention may also be added. Mechanical devices are advantageously used for this purpose, e.g. those described in French Patent Specification No. | 55 |
| 60 | 1,047,713. Suitable emulsifiers are e.g. adducts of ethylene oxide and/or propylene oxide with hydrophobic substances which contain hydroxyl, amino or amido groups. Suitable catalysts for producing foam resins which contain urethane groups are e.g. tertiary amines and/or silaamines, N-substituted aziridines, or hexahydrotriazines, which may | 60 |
| 65 | be used in combination with organometallic compounds. Whereas amines preferentially catalyse the blowing reaction, organometallic compounds preferentially catalyse the | 65 |

| _ | cross-linking reaction. To achieve reaction times which are advantageous for the foaming technique, the most suitable quantity of catalyst is determined empirically according to the constitution of the selected catalyst or catalyst mixture. The amines used may be those commonly used for the production of polyurethane foams, for example | |
|----|---|------|
| 5 | dimethylbenzylamine, N-methylmorpholine, triethylenediamine, dimethylpiperazine, 1,2-dimethylimidazole, dimethylethanolamine, diethanolamine, triethanolamine, diethylaminoethanol, tetramethyl-butane-1,3-diamine, N-methyl-N'-dimethyl-aminoethyl-piperazine or pentamethylene-tetra-amine. The silaamines used are silicon compounds which contain carbon-silicon bonds, | 5 |
| 10 | e.g. as described in German Patent Specification No. 1,229,290. 2,2,4-Trimethyl-2-silamorpholine and 1,3-diethyl-aminomethyl-tetramethyldisiloxane are mentioned here as examples but nitrogen-containing bases such as tetraalkylammonium hydroxides as well as alkalis, alkali metal phenolates or alcoholates, e.g. sodium methylate, may be | . 10 |
| 15 | used. The organic metal compounds which may be used in combination with amines, silaamines and hexahydrotriazines in accordance with German Offenlegungsschrift No. 1,769,043 are preferably organic tin compounds, e.g. tin(II) octoate or dibutyl tin dilaurate. Additives for regulating the cell structure, such as organic or inorganic fillers, | 15 |
| 20 | dyes or plasticizers such as phthalic acid esters may also be used. Foaming is preferably carried out in moulds, the reaction mixture being introduced into a mould. The material of which the mould is made may be of metal, e.g. aluminium, or a synthetic resin, e.g. epoxy resin. The foamable reaction mixture foams up in the mould and forms the moulded product. Foaming in the mould may | 20 |
| 25 | be carried out in such a manner that the moulded product has a cell structure on its surface but it may also be carried out to produce a moulded product with a compact skin and cellular core. According to the invention, this is achieved by introducing so much foamable reaction mixture into the mould that the resulting foam just fills the mould. Alternatively, a larger quantity of foamable reaction mixture than is required for filling the interior of the mould with foam may be introduced. This method is | 25 |
| 30 | known as "overcharging". It has already been disclosed, e.g. in U.S. Patent Specification No. 1,178,490 and 3,182,104. Blowing agents in many cases already known per se are used for foaming in the mould. | 30 |
| 35 | According to the invention, the products produced are in particular cold hardening foams (see British Patent Specification No. 1,162,517 and German Offenlegungs-schrift No. 2,153,086). The silicones used according to the invention are known per se and may be prepared e.g. by the process according to German Patent Specification No. 1,046,049 | 35 |
| 40 | or according to U.S. Patent Specification No. 3,012,052. The foam resins according to the invention may be used for known applications, e.g. in the field of upholstery. The invention will now be further described in the following specific examples in which parts and percentages are in all cases parts and percentages by weight unless | 40 |
| 45 | otherwise specified. Examples The siloxanes used according to the invention are those which can be easily prepared as described in German Patent Specification No. 1,046,049. The siloxanes used in the following examples correspond to the formula on page 4 in which R=methyl and R'=phenyl and they have the following compositions: | 45 |
| 50 | Siloxane 1: 83.5 Parts by weight of the above mentioned formula in which 14.5 parts by weight of the above mentioned formula in which 2.0 parts by weight of the above mentioned formula in which 3.1 Siloxana 2.2 | 50 |
| 55 | Siloxane 2: 15.0 Parts by weight of the above mentioned formula in which 71.0 parts by weight of the above mentioned formula in which 12.3 parts by weight of the above mentioned formula in which 17.7 parts by weight of the above mentioned formula in which 18.7 parts by weight of the above mentioned formula in which | 55 |
| 60 | Siloxane 3: 25.0 Parts by weight of the above mentioned formula in which $a=0$ 74.0 parts by weight of the above mentioned formula in which $a=1$ 1.0 part by weight of the above mentioned formula in which $a=2$. | 60 |

| | | Example 1 | • | , , | • |
|------|--|---|--|---|----|
| 5 | A) Preparation of the polyisocyanate 20 Parts of 1,2-propylene glycol ture of 80% by weight of tolylene-2 2,6-diisocyanate and 274 parts by 60°C, and the mixture was reacted β-phenyl-ethyl-ethyleneimine, the reation which took place at this tempera | 4-diisocyanate and 20 weight of diphenylme for 30 minutes. After ction mixture was her |)% by weight of thane-4,4'-diisocy the addition of lated to 130°C. T | tolylene- anate at I part of rimerisa- | 5 |
| 10 | content of the reaction mixture was sulphonate. After dilution with 624 -2,6-diisocyanate, a polyisocyanate so (%): 38.4, viscosity cP ₂₅ deg C: 24, B) 100 Parts by weight of a polyi | 26.5%, by adding 1 parts of an 80/20 milution was obtained we refractive index n_D^{50} : | part of methyl p xture of tolylene- hich had an NCC 1.5738. | -toluene- 2,4- and content | 10 |
| 15 | propylene glycol and modified with hydroxyl end groups with OH numb weight of endoethylenepiperazine, 0. by weight of siloxane 1 were mixed of the polyisocyanate mentioned abov properties was obtained: | ethylene oxide to re 28, 3.5 parts by we part by weight of together and reacted | esult in 60% of eight of water, 0.1 riethylamine, and with 47.0 parts b | primary l part by 0.9 part v weight | 15 |
| 20 | Density Tensile strength Elongation at break Compression test Flammability according to ASTM | 3571 3571 3577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 38 0.8 150 25 | 20 |
| 25 | Length of burnt sample/average value. Average extinction time Assessment | Example 2 | (cm) (sec.) Self-extinguishin | 6.0 35 ng. | 25 |
| 30 - | A) Preparation of a polyisocyanate 1.33 Parts of 1,2-propylene glyotolylene-2,4- and -2,6-diisocyanate reaction time of 30 minutes, during part of β-phenyl-ethyl-ethyleneimine | col were added to 27, nentioned in Example which time the temper was added. | e 1 at 60°C and rature rose to 80° | C, 0.044 | 30 |
| 35 | Using nitrogen at protective gas, and trimerisation was stopped after a ture, when the NCO value was 25.8 After dilution of the reaction mixture 2,4- and -2,6-diisocyanate, 5.28 par | reaction time of about %, by adding 0.042 with 71.50 parts of a ts of 2.3-dibromopro | t 5 hours at this parts of benzoyl 65/35 mixture of banol were added | tempera- chloride. tolylene- l to this | 35 |
| 40 | solution and reacted for 2 hours at 80 had the following properties. NCO content (%): 38.5, visco 1.5690. | | | | 40 |
| 45 | B) 100 Parts by weight of a polyphydroxydiphenylmethane and modified primary OH end groups with OH no | l with ethylene oxide | n had been starte to result in about | d on di- 60% of | 45 |
| | 3.5 parts by weight of wate 0.1 part by weight of endo 1.0 part by weight of N,N 1.0 part by weight of silox | ethylene piperazine, dimethylbenzylamine | and | | |
| -50 | were mixed together and reacted with pared as described above. A foam res was obtained. | 44.0 parts by weight in which had the follow | of the polyisocyan wing mechanical p | nate pre- properties | 50 |
| 55 | Density DIN 53 Tensile strength DIN 53 Elongation at break DIN 53 Compression test DIN 53 Flammability according to ASTM Length of burnt sample/average value | 8571 8571 8577 D 1692-67 T | (kg/m³) (kp/cm²) (%) (p/cm²) | 40 0.7 160 25 | 55 |
| 60 | Average extinction time Assessment | | (sec.) Self-extinguishin | 3.5 25 g. | 60 |

| 8 | 1,381,571 | 8 |
|----|--|----|
| | Example 3 | |
| 5 | A) Preparation of polyisocyanate 0.040 Part of a solution of water in acetone (25 g of water made up to 1000 ml with acetone) and 0.038 part of β-phenyl-ethyl-ethylene-imine were added to 25.0 parts of the mixture of tolylene-2,4- and -2,6-diisocyanate mentioned in Example 1 at 22°C. After a brief incubation period, the slightly exotheration of the diisocyanate began. It was stopped after a reaction time of about 2 to 2½ hours, when the NCO content was 31% and the reaction temperature 70°C, by adding 0.024 part of methyl p-toluene sulphonate. 3 Parts of tripropylene glycol were added when the temperature of the reaction mixture was 80°C and reacted at that temperature for | 5 |
| 15 | After the addition of 75 parts of an 80/20 mixture of tolylene-2,4- and -2,6-diisocyanate and vigorous homogenization of the reactants, 5.42 parts of 2,3-dibromopropanol were added to the reaction mixture at 90°C. After a reaction time of 2 hours at 90 to 100°C, the polyisocyanate combination had an NCO content (%): 38.2, viscosity $cP_{25 \text{ deg C}}$: 33 and refractive index n_D^{20} : 1.5790. | 15 |
| | B) 100 Parts by weight of a polypropylene glycol which had been started on propylene glycol and modified with ethylene oxide to result in approximately 60% of primary hydroxyl end groups with OH number 28, | |
| 20 | 3.2 parts by weight of water, 0.1 part by weight of endoethylenepiperazine, 0.4 part by weight of triethylamine and 1.0 part by weight of siloxane 2 | 20 |
| 25 | were mixed together and reacted with 45.5 parts by weight of the polyisocyanate pre- pared as described above. A foam resin which had the following mechanical properties was obtained: | 25 |
| 30 | Density DIN 53420 (kg/m³) 35 Tensile strength DIN 53571 (kp/cm²) 0.6 Elongation at break DIN 53571 (%) 135 Compression test DIN 53577 (p/cm²) 20 Flammability according to ASTM D 1692-67 T Length of burnt sample/average value (cm) 6.0 Average extinction time (sec.) 35 Assessment Self-extinguishing. | 30 |
| 35 | Example 4 | 35 |
| 40 | A) Preparation of the polyisocyanate 1.96 Parts of 1,2-propylene glycol were added to 35.0 parts of the mixture of tolylene-2,4- and -2,6-diisocyanate mentioned in Example 1 at 60°C and reacted for 30 minutes, the reaction mixture heating up to 80°C during this time. After the addi- | 33 |
| 40 | tion of 0.037 parts of β -phenyl-ethyl-ethylene imine, the reaction mixture was heated to 130°C and then left at that temperature, at which trimerisation of the isocyanate mixture took place, until the NCO value was 30.0%, which took about 1 to 2 hours. After cooling to 100°C, 3.70 parts of tripropylene glycol were added and reacted at the same temperature over a period of one hour. The reaction mixture which at the | 40 |
| 45 | end of this time had an NCO value of 23.3%, was then diluted with 65.06 parts of an 80/20 mixture of tolylene-2,4- and -2,6-diisocyanate. The resulting polyisocyanate solution had the following properties: NCO content (%): 38.9, viscosity $cP_{25 \text{ deg } C}$: 39, refractive index: n_D^{50} : 1.5642. | 45 |
| | B) 100 Parts by weight of a polypropylene glycol which had been started on tri- | |

B) 100 Parts by weight of a polypropylene glycol which had been started on trimethylolpropane and modified with ethylene oxide to result in approximately 60% of primary hydroxyl end groups with OH number 28, 2.6 parts by weight of water, 6.15 parts by weight of endoethylenepiperazine, 0.40 parts by weight of tetramethylethylenediamine and 2.0 parts by weight of siloxane 3 were mixed together and reacted with 38.8 parts by weight of the polyisocyanate mentioned above.

50

| *************************************** | *** - The rest of the second o | | | |
|---|--|--|---|---|
| | A foam resin which ha | d the following mechanical pr | operties was obta | ined: |
| 5 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 41 0.6 135 20 5 |
| | Flammability according to Length of burnt sample/ave Average extinction time | ASTM D 1692-67 T | (cm) (sec.) | 4.1 30 |
| | Assessment | - | Self-extinguishir | |
| 10 | A) If the process were carr | Example 5 ried out in the same way as is | described under | 7 A) but |
| 15 | reaction mixture was diluted and -2,6-diisocyanate, then | pane were used instead of tril with 66.30 parts of an 80/20 the polyisocyanate solution of 6): 39.0, viscosity cP _{25 deg C} : | mixture of toly | lene-2,4- following |
| | B) 100 Parts by weight of methylolpropane and modifie of primary hydroxyl end gro | a polypropylene glycol which ed with ethylene oxide to resu pups with OH number 32.0, | had been started lit in approximate | l on tri- ely 70% |
| 20 | 2.5 parts by weight 0.1 part by weight 1.0 part by weight 1.5 parts by weight | of endoethylenepiperazine, of N,N-dimethyl-benzylamine | and _ | 20 |
| 25 | were mixed together and rea pared as described above. A obtained. | cted with 37.5 parts by weight foam resin with the following | of the polyisocyar mechanical prope | nate pre- rties was 25 |
| 30 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/ave Average extinction time Assessment | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T rage value | (kg/m³) (kp/cm²) (%) (p/cm²) (cm) (sec.) Self-extinguishin | 42 0.6 140 22 30 4.0 40.0 g- |
| 3 5 | | E-romals 6 | | 0 # |
| 33 | 2,4-diisocyanate in a vessel e | Example 6 ranate ene glycol were added at 60°C equipped with a stirrer, using r for 30 minutes, during which | itrogen as protec | tive gas. |
| 40 | β -phenyl-ethyl-ethyleneimine, left at this temperature until | an external source. After the a the reaction mixture was he after about 5 to 6 hours, the cyanate was then stopped by the | addition of 0.060 ated to 130°C a NCO value was | parts of 40 and then 260% |
| 45 | of methyl-p-toluene sulphona diluted with 60.0 parts of a | te, and after cooling to 120°C, n 80/20 mixture of tolylene-2 ollowing properties: NCO conto | the reaction mix | ture was |
| 50 | triol and modified with ethy groups with OH number 35 endoethylenepiperazine, 0.4 retramethylethylene diamine and reacted with 37.0 parts | a polypropylene glycol which hay lene oxide to result in 60%, 2.5 parts by weight of wate parts by weight of triethylamin and 1.0 part by weight of siloxa by weight of the polyisocyana he following mechanical prope | of primary hydror, 0.1 part by we, 0.2 parts by we let 1 were mixed | eight of 50 together |

| | ······································ | | | | |
|-----------|--|--|--|---|-------------|
| | Density Tensile strength Elongation at break | DIN 53420 DIN 53571 DIN 53571 | (kg/m³) (kp/cm²) (%) | 42 0.6 130 | |
| 5 | Compression test Flammability according to Length of burnt sample/ave Average extinction time Assessment | DIN 53577 ASTM D 1692-67 T | (p/cm²) (cm) (sec.) Self-extinguishin | 4.0 45.0 | 5 |
| 10 | A) Preparation of the poly 0.061 Parts of a solution | Example 7 risocyanate n of water in acetone (25 g of | water made up to | 1000 ml | 10 |
| 15 | parts of tolylene-2,4-diisocyathe diisocyanzte began after 2 hours when the NCO valupart of benzoyl chloride. | rts of β -phenyl-ethyl-ethyleneir anate at 25°C. The slightly et a brief incubation period and ue had reached 31.0 to 31.3% | nine were added xothermic trimeri: I was stopped aft, by the addition | to 38.76 sation of er about of 0.042 | 15 |
| 20 | glycol were added over a per to 95—100°C. Stirring was the reaction mixture was the and -2,6-diisocyanate (80:2 polyisocyanate in tolylene di | was then heated to 80°C and eriod of 10 to 15 minutes, the continued for one hour without of diluted with 58.91 parts of 10% by weight). The solution diisocyanate had the following age: 54, refractive index n _D ²⁰ : | reaction temperatu ut further heat sur- a mixture of toly of modified ison properties: NCO | re rising pply and lene-2,4- evanurate | 20 |
| 25 | methylolpropane and modified hydroxyl end groups with (by weight of endoethylener | of a polypropylene glycol which are of the original original of the original origi | sult in 60% of weight of water, of triethylamine | primary 0.1 part and 2.0 | 25 |
| 30 | weight of the polyisocyanate anical properties was obtain | mentioned above. A foam resident | n with the following | ng mech- | 30 |
| 35 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/av Average extinction time Assessment | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T erage value | (kg/m³) (kp/cm²) (%) (p/cm²) (cm) (sec.) Self-extinguishir | 43 0.6 135 25 4.0 42.0 | 35 |
| 40 | A) Preparation of the polyis | Example 8 socyanate opropanol were added to 95 | J | J | 40 |
| 45 | and the mixture was reacte | escribed in Example 4 in toly d at this temperature for 2 houldowing properties: NCO control NCO contr | dene diisocyanate | at 90°C | 45 |
| 50 | glycerol and modified with groups with OH number 32 endoethylenepiperazine, 0.5 parts by weight of siloxane weight of the polyisocyanate | of a polypropylene glycol wethylene oxide to result in 60% 5.0, 2.5 parts by weight of wa parts by weight of tetramethy 3 were mixed together and reprepared as described above, a following mechanical propert | of primary hydr ter, 0.1 part by v d-ethylenediamine teacted with 37.5 | roxyl end veight of and 1.8 parts by | 50 |
| 55 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/av | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T | (kg/m³) (kp/cm²) (%) (p/cm²) | 43 0.7 130 22 3.0 | 55 |
| 60 | Average extinction time Assessment | | (sec.) Self-extinguishin | 25.0 | 60 |

| | Example 9 | • | |
|----------|---|--|-----|
| - 5 | A) Preparation of the polyisocyanate 20 Parts of 1,2-propylene glycol were added at 60° of a mixture of 80% by weight of tolylene-2,4-diisocya | nate and 200/ by weight of | |
| | tolylene-2,6-diisocyanate and 275 parts of diphenylme reacted for 30 minutes. After the addition of 1 part of reaction mixture was heated to 130°C. The trimerisative temperature was stopped after 2½ hours, when the NCO ture was 26.5% by adding 1 part of methylene and | β-phenyl-ethyleneimine, the on which took place at this | 5 |
| 10 | ture was 26.5%, by adding 1 part of methyltoluenesuly 624 parts of an 80/20 mixture of tolylene-2,4- and -2,6-c solution which had the following properties was obtained viscosity cP _{25 deg C} : 24, refractive index n _D ⁵⁰ : 1.5738. | lisocuanate a nolivicocuanata | 10 |
| 15 | B) 100.0 Parts by weight of a polypropylene glycol sorbitol and modified with ethylene oxide to result in a hydroxyl end groups with OH number 35, 2.5 parts by weight of endoethylenepiperazine, 0.3 parts by weight of and 2.0 parts by weight of siloxane 1 were mixed together parts by weight of the polyisocyanate mentioned above. A foam resin with the following mechanical proper | more than 10% of primary weight of water, 0.1 part by f N,N-dimethyl-benzylamine ether and reacted with 34.5 | 15 |
| 20 25 | Density DIN 53420 Tensile strength DIN 53571 Elongation at break DIN 53571 Compression test DIN 53577 Flammability according to ASTM D 1692-67 T | (kg/m³) 45 (kp/cm²) 0.5 (%) 160 (p/cm²) 20 | 20 |
| 23 | Length of burnt sample/average value Average extinction time Assessment | (cm) 4.5 (sec.) 42.0 Self-extinguishing. | 25 |
| | A) Preparation of the polyisocyanate | | |
| 30 | 1.54 Parts of 1,2-propylene glycol were added to disocyanate at 60°C in a vessel equipped with stirrer, gas, and the mixture was reacted for 30 minutes, during 95—100°C without heating from an external source. | using nitrogen as protective which time it heated up to | 30 |
| 35 | left at this temperature until, after about 5 to 6 hours, the merisation of polyisocyanate was then stopped by the a methyl p-toluene sulphonate and after cooling the reaction diluted with 60.0 parts of an 80/20 mixture of tolyiene | e was heated to 130°C and NCO value is 26.0%. Tri- ddition of 0.038 parts of a mixture to 120°C it was | 35 |
| 40 | cP _{25 deg O} : 63, refractive index: n_D^{56} : 1.5721. | content (%): 39.4, viscosity | 40 |
| | B) 100 Parts by weight of a polypropylene glycol which methylolpropane and modified with ethylene oxide to result hydroxyl end groups with OH number 20, 2.5 parts by weight of endoethylenepiperazine, 0.3 parts by weight amine and 1.2 parts by weight of eilenen | t in about 40% of primary weight of water, 0.20 parts | * |
| 45 | amine and 1.2 parts by weight of siloxane 1 were mixed 35.0 parts by weight of the polyisocyanate mentioned abo A foam resin with the following mechanical properties | together and reacted with | 45 |
| | Density DIN 53420 | (kg/m³) 45 | . * |
| 50 | Tensile strength DIN 53571 Elongation at break DIN 53571 Compression test DIN 53577 Flammability according to ASTM D 1692-67 T | (kp/cm²) 0.6 (%) 130 (p/cm²) 25 | 50 |
| 55 | Length of burnt sample/average value Average extinction time Assessment | (cm) 5.0 (sec.) 30.0 | |
| | Example 11 | Self-extinguishing. | 55 |
| | Hyamala 13 | | |

Example 11

100 Parts by weight of a polypropylene glycol which had been started on dipropylene glycol and modified with ethylene oxide to result in 60% of primary hydroxyl end groups with OH number 28, 3.5 parts by weight of water, 0.1 part by

| 5 | by weight of siloxane 1 wer of a polyisocyanate containing by reacting a mixture of tol- by weight) and water (NCC) | azine, 0.6 parts by weight of the mixed together and reacted and biuret groups, which polyison ylene-2,4- and -2,6-diisocyanate of content 38.5%). following mechanical properties | with 45.5 parts by weight cyanate had been prepared (ratio of isomers 65:35% | 5 |
|----|--|---|---|--------------|
| 10 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/av Average extinction time Assessment | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T erage value | (kg/m³) 35 (kp/cm²) 0.6 (%) 150 (p/cm²) 25 (cm) 6.0 (sec.) 50.0 Self-extinguishing. | 10 |
| 15 | 100 Parts by weight of | Example 12 of a polypropylene glycol whic d modified with ethylene oxide | h had been started on di- | 15 |
| 20 | 60% of primary OH end g 0.1 part by weight of end and 1.2 parts by weight o parts by weight of a biure mixture of toluene-2.4- and | proups with OH number 28, 3.5 oethylenepiperazine, 0.6 parts if siloxane 1 were mixed toget to polyisocyanate which had be 1-2,6-diisocyanate (ratio of iso 38.5%). A foam resin with the | 5 parts by weight of water, by weight of triethylamine ther and reacted with 45.5 ten prepared by reacting a somers 80:20% by weight) | 20 |
| 25 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) 35 (kp/cm²) 0.7 (%) 160 (p/cm²) 23 | 25 |
| 30 | Flammability according to Length of burnt sample/a: Average extinction time Assessment | | (cm) 5.7 (sec.) 47.0 Self-extinguishing. | 30 |
| 35 | methylolpropane and modi of primary hydroxyl end g 0.1 part by weight of end phosphate and 1.0 part by 43.0 parts by weight of a | Example 13 of a polypropylene glycol which fied with ethylene oxide to reproup with OH number 20, 3.3 oethylenepiperazine, 5.0 parts the weight of siloxane 1 were mixed biuret polyisocyanate which had ith water (NCO content 38.5% | sult in approximately 60% parts by weight of water by weight of trichloroethyled together and reacted with been prepared by reacting | 35 - 1 |
| 40 | A foam resin with th | e following mechanical propert | ies was obtained: | 40 |
| 45 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/a Average extinction time Assessment | | (kg/m²) 37 (kp/cm²) 0.6 (%) 140 (p/cm²) 23 (cm) 3.0 (sec.) 25.0 Self-extinguishing. | 45 |
| 50 | methylolpropane and mod | Example 14 of a polypropylene glycol which ified with ethylene oxide to regroups with OH number 32, 2. | sult in approximately 70% | 6 |
| 55 | 0.1 part by weight of end henzylamine and 2.5 parts | doethylenepiperazine, 1.0 part to s by weight of siloxane 1 were tof a biuret polyisocyanate whi | by weight of N,N-dimethyl mixed together and reacte | L d 55 |

| | | | | | 13 |
|-------------|---|--|---|-------------------------------------|----|
| | and water (NCO content | ene-2,4- and -2,6-diisocyanate 38.5%). | | | |
| | A loam resin with th | e following mechanical propert | ties was obtained: | | |
| 5 | Density Tensile strength Elongation at break Compression test Flammability according to | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 40 0.7 130 25 | 5 |
| 10 | Length of burnt sample/a Average extinction time Assessment | verage value | (cm) (sec.) Self-extinguis | 7.0 60.0 hing. | 10 |
| 15 _ | of primary hydroxyl end g 0.1 part by weight of end | Example 15 of a polypropylene glycol whi fied with ethylene oxide to re proups with OH number 48, 2 oethylenepiperazine, 0.3 parts | esult in approximus.5 parts by weight | ately 60% at of water, | 15 |
| 20 | with 38.0 parts by weight reacting a mixture of toly by weight) and water (NC | of a biuret polyisocyanate whene-2,4- and -2,6-diisocyanate O content 38.5% | mixed together a hich had been per cratio of isomer | ind reacted | 20 |
| | A foam resin with the | following mechanical properti | ies was obtained: | | 20 |
| 25 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) | 42 0.7 120 | Ē |
| | Flammability according to Length of burnt sample/av Average extinction time Assessment | ASTM D 1692-67 T | (p/cm²) (cm) (sec.) Self-extinguish | 25 6.0 35 ing. | 25 |
| 30 | and modified with chiviens | Example 16 a polypropylene glycol which oxide to result in 28% of property to the control of the | ····· 1 | • " | 30 |
| 35 | ethylenepiperazine, 0.1 part by weight of siloxane 1 we of a biuret polyisocyanate w 2,4- and -2,6-diisocyanate content 38.5%). | parts by weight of water, 0.20 by weight of pentamethyldier are mixed together and reacted thich had been prepared by rea (ratio of isomer 65:35% by following mechanical properties | parts by weight hylenetriamine and with 42.0 parts acting a mixture o weight) with wa | of endo- d 1.0 part by weight | 35 |
| 40 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 45 0.7 120 30 | 40 |
| 45 | Flammability according to Length of burnt sample/av Average extinction time Assessment | ASTM D 1692-67 T erage value | (cm) (sec.) Self-extinguishi | 4.0 38 | 45 |
| | | | | | |
| 50 | with OH number 35, 2.5 par piperazine, 0.5 parts by weigh | Example 17 a polypropylene glycol which he oxide to result in 60% of pricts by weight of water, 0.1 participate of tetramethylethylenediam in the control with 200 miles. | mary hydroxyl ende | nd groups pethylene- | 50 |
| 55 | polyisocyanate which had he | gether and reacted with 38.0 peen prepared by reacting a misomers 80:20% by weight) | parts by weight o | f a biuret | 55 |
| | | | | | |

A foam resin with the following mechanical properties was obtained:

| 5 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/av Average extinction time Assessment | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T erage value | (kg/m²) (kp/cm²) (%) (p/cm²) (cm) (sec.) Self-extinguishin | 40 0.7 130 30 3.5 42 | 5 |
|----|--|--|--|--|----|
| 10 | and modified with ethylene | Example 18 a polypropylene glycol which hoxide to result in approximately | y 60% of primary | hydroxyl | 10 |
| 15 | endoethylenepiperazine, 1.0 butane-1,4-diol and 1.0 pa by weight of a biuret polyi of tolylene-2,4- and -2,6-d water (NCO content 38.5% | part 48, 2.5 parts by weight of weight by weight of triethylaming the by weight of siloxane 1 we socyanate which had been preprisocyanate (ratio of isomers 8 (s)). | ne, 1.5 parts by the reacted with 4 pared by reacting a 10 to 20% by we | weight of 0.5 parts 1 mixture | 15 |
| 20 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 48 0.9 130 28 | 20 |
| 25 | Flammability according to Length of burnt sample/av Average extinction time Assessment | erage value | (cm) (sec.) Self-extinguishi | 3.5 35 ing. | 25 |
| 30 | propylene glycol and mod of primary hydroxyl end g 0.1 part by weight of en- ethylenediamine, 1.5 part of siloxane 2 were reacted | Example 19 of a polypropylene glycol which ified with ethylene oxide to re roups with OH number 28, 2. doethylenepiperazine, 0.5 parts by weight of tripropylene glyc with 41.5 parts by weight of a | sult in approxima 5 parts by weight by weight of ter tol and 2.0 parts biuret polyisocyan | of water, of water, tramethyl- by weight ate which | 30 |
| 35 | of isomers 80:20% by we | ting a mixture of tolylene-2,4- ight and water (NCO content following mechanical properti | 38.5%). | nate (ratio | 35 |
| 40 | Density Tensile strength Elongation at break Compression test Flammability according t Length of burnt sample/a | o ASTM D 1692-67 T | (kg/m³) (kp/cm²) (%) (p/cm²) (cm) | 45 0.8 120 30 | 40 |
| 45 | Average extinction time Assessment | | (sec.) Self-extinguish | 28 ing. | 45 |
| 50 | methylolpropane and mod- of primary hydroxyl end g 0.1 part by weight of end benzylamine, 1.0 part by w 1 were reacted with 41.5 | Example 20 of a polypropylene glycol white the strong with end of the proups with OH number 35, 2. The strong with oethylenepiperazine, 1.5 parts beight of diethyleneglycol and 1. The parts by weight of a biuret polypene-2,4-diisocyanate, and water | sult in approxima 5 parts by weight by weight of N,N 5 parts by weight of lyisocyanate which | of water, dimethyl- stiloxane had been | 50 |

| | A foam resin with the | following mechanical properties | s was obtained: | | |
|----|---|--|---|-----------------------------------|-----|
| 5 | Density Tensile strength Elongation at break Compression test | DIN 53420 DIN 53571 DIN 53571 DIN 53577 | (kg/m³) (kp/cm²) (%) (p/cm²) | 45 0.9 130 32 | . 5 |
| : | Flammability according to Length of burnt sample/av Average extinction time Assessment | ASTM D 1692-67 T | (cm) (sec.) Self-extinguishir | 3. <i>5</i> 30.0 | , |
| 10 | | Example 21 | J | • | 10 |
| | end groups with OH number endoethylenepiperazine, 0.8 | a polypropylene glycol which I oxide to result in approximately 30, 2.5 parts by weight of w parts by weight of butane-1,4 | 7 65% of primary ater, 0.1 part by v I-diol. 0.2 parts b | hydroxyl veight of v weight | |
| 15 | with 40.5 parts by weight of acting tolylene-2,4-diisocyar A foam resin with the | and 1.8 parts by weight of a biuret polyisocyanate which hate and water (NCO content following mechanical propertie | had been prepare 38.5%). | reacted d by re- | 15 |
| 20 | Density Tensile strength Elongation at break | DIN 53420 DIN 53571 DIN 53571 | (kg/m³) (kp/cm²) (%) | 46 0.7 | 20 |
| | Compression test Flammability according to | DIN 53577 ASTM D 1692-67 T | (p/cm²) | 120 30 | |
| 25 | Length of burnt sample/av Average extinction time Assessment | erage value | (cm) (sec.) | 4.2 30 | 25 |
| | 1135C3SINCIN | Example 22 | Self-extinguishin | g. | |
| 30 | of primary hydroxyl end gr 0.2 parts by weight of end | f a polypropylene glycol which ied with ethylene oxide to res- oups with OH number 35, 3.0 loethylenepiperazine, 1.0 part b siloxane 1 were reacted with | ult in approximate parts by weight ov y weight of triet | ely 60% of water, hylaminė | 30 |
| 35 | methane-4,4'- and -2,4'-diss (NCO content 30.0%). | had been prepared by reacting ocyanate (ratio of isomers 60:4 following mechanical properties | ng a mixture of d 10% by weight) and | linhenvl- | 35 |
| | Density | DIN 53420 | (kg/m^3) | 42 | |
| | Tensile strength | DIN 53571 | (kp/cm²) | 1.0 | |
| | Elongation at break | DIN 53571 | (%) | 140 | |
| 40 | Compression test | DIN 53577 | (kp/cm²) | 38 | 40 |
| | Flammability according to Length of burnt sample/av | ASTM D 1692-67 T | | | |
| | Average extinction time | erage value | (cm) | 5.3 | |
| | Assessment | | (sec.) Self-extinguishin | · 40 | |
| 45 | | Example 23 | • | • | 45 |
| - | primary hydroxyl end groun | of a polypropylene glycol with ethylene oxide to result it is with OH number 35.0, 2.5 | n approximately a | 60% of | 40 |
| 50 | 38.0 parts by weight of an trimethylolpropane and tolyl by weight). | pethylenepiperazine, 0.7 parts the eight of siloxane 1 were mixed isocyanate adduct (NCO contene-2,4- and -2,6-diisocyanate in the eight of the eigh | together and react tent 35%) obtained (ratio of isomers 8 | ted with | 50 |
| | A foam resin with the | following mechanical properties | was obtained: | | |
| 55 | Density Tensile strength | DIN 53420 DIN 53571 | (kg/m^3) (kp/cm^2) | 43 0.7 | 55 |
| | Elongation at break Compression test | DIN 53571 DIN 53577 | 3.51 | 130 25 | ٠ |
| 60 | Flammability according to Length of burnt sample/ave | ASIM D 1092-67 T | () | 2.5 | |
| 00 | Average extinction time Assessment | rage value | (cm) (sec.) Self-extinguishing | 3.5 28 z. | 60 |
| | ž. | • | | ,- | |

| 5 | glycerol and modified with hydroxyl end groups with by weight of endoethylene amine and 3.0 parts by we 38.0 parts by weight of ar trimethylolpropane and toly | OH number 35.0, 2.5 par piperazine, 0.5 parts by eight of siloxane 1 were isocyanate adduct (NC | n approximately 60% of ts by weight of water, weight of tetramethyle mixed together and re O) content (35%) obta | of primary 0.18 parts ethylenedi- acted with ained from | 5 |
|--------------------------|---|--|--|--|----|
| 10 | by weight). A foam resin with the | following mechanical pr | operties was obtained: | | 10 |
| 15 | Density Tensile strength Elongation at break Compression test Flammability according to Length of burnt sample/a Average extinction time Assessment | | (kg/m²) (kp/cm²) (%) (p/cm²) (cm) (sec.) Self-extinguish | 44 0.6 120 25 4.0 35 ning. | 15 |
| 20 | 100 0 Posts for socials | Example 25 | | | 20 |
| 20 | of primary hydroxyl end g 0.15 parts by weight of en benzylamine and 1.3 parts | roups with OH number 3 doethylenepiperazine, 1.0 by weight of siloxane 3 | to result in approxim 2.0, 2.5 parts by weigh part by weight of N,N were mixed together a | ately 70% at of water, I-dimethyl- and reacted | 20 |
| 25 | , | ylene-2,4- and -2,6-diisoc e following mechanical pr | yanate (ratio of isomer | s 80:20% | 25 |
| 30 | Density Tensile strength Elongation at break Compression test Flammability according to | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T | (kg/m³) (kp/cm²) (%) (p/cm²) | 44 0.7 135 28 | 30 |
| 35 | Length of burnt sample/a Average extinction time Assessment | iverage value | (cm) (sec.) Self-extinguisl | 4.5 35 hing. | 35 |
| 4 0 4 5 | Example 26 100.0 Parts by weight of a polypropylene glycol which had been started on propylene glycol and modified with ethylene oxide to result in approximately 60% of primary hydroxyl end groups with OH number 28, 3.5 parts by weight of water, 0.1 part by weight of endoethylenepiperazine, 3.25 parts by weight of diisopropanolamine and 0.80 parts by weight of siloxane 1 were mixed together and reacted with 55.60 parts by weight of an isocyanate adduct (NCO content 35%) prepared from trimethylolpropane and tolylene-2,4- and -2,6-diisocyanate (ratio of isomers 80:20% by weight). | | | ly 60% of water, 0.1 panolamine with 55.60 from tries 80:20% | 40 |
| | Density | e following mechanical property 53420 | (kg/m³) | 39 | - |
| 50 | Tensile strength Elongation at break Compression test Flammability according t Length of burnt sample/ Average extinction time Assessment | DIN 53571 DIN 53571 DIN 53577 o ASTM D 1692-67 T average value | (kp/cm² (%) (p/cm²) (cm) (sec.) Self-extinguis | 1.1 140 30 5.7 50 hing. | 50 |
| 55 | 100.0 Parts by weig glycerol and modified with hydroxyl end groups with weight of endoethylenepip | OH number 32, 2.5 part | in approximately 70% s by weight of water. (| of primary | 55 |

| | | | | | | _, |
|---|----------|---|---|--|---|-----------|
| | 5 | 1.5 parts by weight of die methane and 1.2 parts by of an isocyanate adduct (methylolpropane and tolyl by weight). | (NCO content 35%) whene-2,4- and -2,6-diisoc | e reacted with 37.5 part hich had been prepare cyanate (ratio of isome | s by weight d from tri- rs 80:20% | 5 |
| | | A foam resin with the following mechanical properties was obtained: | | | | |
| | | Density Tensile strength | DIN 53420 DIN 53571 | (kg/m³) (kp/cm²) | 43 0.6 | |
| | 10 | Elongation at break Compression test | DIN 53571 | (%) | 135 | |
| | 10 | Flammability according to Length of burnt sample/a | DIN 53577 to ASTM D 1692-67 T | | 35 | 10 |
| | | Average extinction time | verage value | (cm) (sec.) | 3.0 30 | |
| | | Assessment | | Self-extinguish | | |
| | 15 | | Example 28 | | _ | |
| | | A) 100.0 Parts by weigh | ht of a polypropylene of | zlycol which had been | started on | 15 |
| | | ary hydroxyl end groups v parts by weight of endoeth | with OH number 35.0, 2 vienepiperazine, 0.7 part | olt in approximately 60° 2.5 parts by weight of N other | % of prim- water, 0.15 | |
| | 20 | and 1.0 part by weight of s by weight of an allophana | SHOXADE 3 Were mixed to | oether and reacted with | 40.0 parts | 20 |
| | | B) Preparation of the polyi | socvanate | | | |
| | | 134 Parts of trimethyl | Oluronane were added or | ver a period of about o | ne hour to | |
| | 25 | a mixture of tolylene-2,4- been introduced into a real | and -/.o-misocvanare/ra | ITIA At icamana PA AITI | | |
| | | meenymipropane, me reach | UU IIIIXTUTE Neated im to | $114^{\circ}C$ W/han the N/C | ```` | 25 |
| | | mad reaction a toyet of 41. |) % . IIIIIIDediately after c | commission of the addition | : c : | |
| | | methylol-propane, the react perature for 20 hours. The | TESTITION DECOMES WAS A | columbiam of an all | | |
| | 30 | mood and a milking of the | olylene diisocyanate isome | ers, NCO content 38.1% | nate poly- | 30 |
| | | as deg U //• | | | | • |
| | | at 00 C and reacted for 23 | mopropanol-1 were add hours at 90°C. The m | Oditied allowbanes I- | | |
| | 35 | an one isometre wryterie at | isocvanate mixing had | an NCO content of | 35.1%, a | _ |
| | J | Trocostry of 110 Cl 25 deg C d | following mechanical pr | 110/ | | - 35 |
| | | | | operacs was obtained: | | |
| | | Density Tensile strength | DIN 53420 DIN 53571 | (kg/m^3) | 50 | |
| | | Elongation at break | DIN 53571 | (kp/cm²) (%) | 0.8 | |
| | 40 | Compression test | DIN 53577 | (p/cm^2) | 120 35 | 40 |
| | | Flammability according to Length of burnt sample/av | ASTM D 1692-67 T | | | -10 |
| | | Average extinction time | crage value | (cm) (sec.) | 3.0 25 | |
| | | Assessment | | Self-extinguishi | ing. | |
| | 45 | | Example 29 | _ | J | • |
| | | A) 100.0 Parts by weight | of a polypropylene gly | col which had been s | torted on | 45 |
| | | Expected and injulied Willi | CLIIVIENE OYIOP TO recitle : | in 6()0/ of normanii 1 | | |
| | | endoethylenepiperazine. 0.5 | Darts by weight of tot | of water, 0.1 part by | weight of | |
| | 50 | | | | and 1.0 | . 50 |
| | | weight of an allophanate po | olyisocyanate (NCO con | tent 35.1%). | pares by | 50 |
| | | B) Preparation of the polyise | ocvanate | | | |
| | | 134 Parts of trimethyle | ninronane were added a | ver a period of about | one hour | |
| | 55 | to a mixime of folyicite-7. | += 200 =/.0=00000000000000000000000000000000 | frotio of iname on the | | |
| • | <i></i> | heated up to 114°C. When | the NCO content reaches | d to 80°C. The reaction | n mixture | 55 |
| | | Products of the addition of | LIMICLIEVICIONISTATIC TRA | TAGATION MINISTER | | |
| | | 150°C and left at this tempe | erature for 20 hours. The | resulting product was | a solution | |
| | | | | | | |

| | of an allophanate polyisocya | nate in a mixture of tolylene and a viscosity of 77 cP _{25 deg} c- | diisocyanate isomers with | |
|-----------|--|--|--|-----------------|
| 5 | 100 Parts of 2,3-dibrom 80°C and reacted for 2½ ho the mixture of tolylene diisoc of 118 cP _{20 der G} and a solid | nopropanol-1 were added to 19 ours at 90°C. The modified all cyanate isomers had an NCO co | 00 parts of this solution at ophanate polyisocyanate in ontent of 35.1%, a viscosity | 5 |
| 10 | Density Tensile strength Elongation at break Compression test Flammability according to | DIN 53420 DIN 53571 DIN 53571 DIN 53577 ASTM D 1692-67 T | (kg/m³) 50 (kp/cm²) 0.8 (%) 130 (p/cm²) 30 | 10 |
| 15 | Length of burnt sample/av Average extinction time Assessment | | (cm) 3.6 (sec.) 28 Self-extinguishing. | 15 |
| 20 | methylolpropane and modified primary hydroxyl end ground 0.2 parts by weight of endoamine and 1.0 part by weight | Example 30 of a polypropylene glycol which is a polypropylene glycol which is a polypropylene glycol which is a polypropylene glycol with OH number 35, 2.5 pethylenepiperazine, 1.0 part by ight of siloxane 1 were mixed allophanate polyisocyanate (N | sult in approximately 60% parts by weight of water, weight of dimethylbenzyltogether and reacted with | 20 |
| 25 | a mixture of tolylene-2,4- been introduced into a reac ing up to 114°C. When the | olpropane were added over a pand -2,6-diisocyanate (ratio of tion vessel and heated to 80°C he NCO content reached a va | isomers 80:20) which had the reaction mixture heat- lue of 41.3%, immediately | 25 |
| 30 | to 150°C and kept at this solution of an allophanate mers, NCO content 38.1% | tion of trimethylolpropane, the temperature for 20 hours. To polyisocyanate in a mixture of the viscosity 77 cP _{25 deg} controller following mechanical properties | he resulting product was a f tolylene diisocyanate iso- | 30 |
| 35 | Density Tensile strength Elongation at break Compression test Flammability according to | | (kg/m³) 48 (kp/cm²) 0.8 (%) 120 (p/cm²) 35 | 35 |
| 40 | Length of burnt sample/a Average extinction time Assessment | verage value | (cm) 4.0 (sec.) 42 Self-extinguishing. | 40 |
| 45 | propylene glycol and mod hydroxyl end groups with by weight of endoethylenel parts by weight of triethyl | Example 31 of a polypropylene glycol whified with ethylene oxide to OH number 28.0, 2.5 parts by piperazine, 0.4 parts by weight amine and 1.3 parts by weight 7.0 parts by weight of an alloping | result in 60% of primary y weight of water, 0.1 part of N-ethylmorpholine, 0.4 t of siloxane 1 were mixed | 45 |
| - 50 | a mixture of tolylene-2,4- been heated to 80°C, the re- tent reached a value of 41 | lolpropane were added over a and -2,6-diisocyanate (ratio of eaction mixture heating up to 1 .3%, immediately after complete | isomers 80:20) which had 14°C. When the NCO con- ction of the addition of tri- | 50 |
| 55 | ture for 20 hours. The re cyanate in a mixture of tol 77 cP ₂₅ des C- 100 Parts of 2,3-dibro | on mixture was heated to 150° sulting product was a solution lylene diisocyanate isomers, NO mopropanol-1 were added to 1 tours at 90°C. The modified a | of an allophanate polyiso- CO content 38.1%, viscosity | _, 55 |

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the mixture of tolylene diisocyanate isomers had an NCO content of 35.1%, a viscosity of 118 cP_{25 deg C} and a solids content of 41%.

A foam resin with the following mechanical properties was obtained:

| - | Density | DIN 53420 | (kg/m^3) | 42 | |
|---|--------------------------|--------------------|---------------|-----|------|
| | Tensile strength | DIN 53571 | (kp/cm²) | 0.7 | . = |
| | Elongation at break | DIN 53571 | (%) | 130 | 3 |
| | Compression test | DIN 53577 | (p/cm²) | 30 | |
| | Flammability according t | o ASTM D 1692-67 T | (P) (III) | | ı |
| | Length of burnt sample | average value | (cm) | 4.4 | |
| | Average extinction time | _ | (sec.) | 30 | . 10 |
| | Assessment | | Self-extingui | | . 10 |
| | | | | | |

Example 32

100 Parts by weight of a polypropylene glycol which had been started on trimethylolpropane and modified with ethylene oxide to result in approximately 60% of primary hydroxyl end groups with OH number 35, 3.0 parts by weight of water, 0.2 parts by weight of endoethylenepiperazine, 0.2 parts by weight of tetramethylethylenediamine, 5.0 parts by weight of trichloroethylphosphate and 1.0 part by weight of siloxane 1 were mixed together and reacted with 40.5 parts by weight of a mixture consisting of 60 parts by weight of tolylene-2,4- and -2,6-diisocyanate (ratio of isomer 65:35) and 40 parts by weight of a polyphenylpolymethylene polyisocyanate (NCO content 31%).

A foam resin with the following mechanical properties was obtained:

| Density DIN 53420 Tensile strength DIN 53571 Elongation at break DIN 53571 Compression test DIN 53577 Flammability according to ASTM D 1692-67 T | (kg/m³) (kp/cm²) (%) (p/cm²) | 35 0.5 90 18 | 25 | |
|--|---------------------------------------|----------------------------------|---------------------|----|
| Length of burnt sample/ave Average extinction time Assessment | rage value | (cm) (sec.) Self-extinguis | 4.9 35 Shing. | 30 |

WHAT WE CLAIM IS: -

1. A process for the production of an open-celled flame-resistant foam resin which contains usethane groups, from a polyether which contains active hydrogen atoms, a polyisocyanate, water and/or an organic blowing agent in the presence of a silicon compound, in which the silicon compound is a siloxane of the general formula

$$R_3-SiO-\begin{bmatrix} R^1 \\ -Si-O- \\ O \\ SiR_3 \end{bmatrix}_{\underline{\alpha}}$$

in which R represents an aliphatic hydrocarbon radical, R' represents a monovalent aromatic radical and a represents 0 or an integer of from 1 to 3, at least 70% by weight of the siloxane mixture consisting of siloxanes in which a=1 while siloxanes in which a=0, a=2 and a=3 are present in the mixture in proportions of not more than 25% by weight, 20% by weight and 5% by weight, respectively.

2. A process as claimed in claim 1 in which between 0.1 and 25% by weight of the siloxane, based on the quantity of foam resin, is used.

3. A process as claimed in claim 2 in which between 0.20 to 5% by weight of the siloxane is used.

4. A process as claimed in any of claims 1 to 3 in which, in the general formula of claim 1, R represents an aliphatic hydrocarbon radical which contains less than 3 carbon atoms.

5. A process as claimed in claim 4 in which, in the general formula of claim 1, R represents a methyl group.

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6. A process as claimed in any of claims 1 to 5 in which, in the general formula of claim 1, R' represents a phenyl radical.

7. A process as claimed in any of claims 1 to 6 in which the polyisocyanate is tolylene-2,4-diisocyanate, tolylene-2,6-diisocyanate or any mixture of these isomers.

8. A process as claimed in any of claims 1 to 6 in which the polyisocyanate is a polyphenyl-polymethylene-polyisocyanate which has been obtained by aniline-formaldehyde condensation followed by phosgenation.

9. A process as claimed in any of claims 1 to 6 in which the polyisocyanate is a solution of a polyisocyanate containing biuret, allophanate, urethane or isocyanurate groups in a polyisocyanate which is free from such groups.

10. A process as claimed in claim 9 in which the polyisocyanate solution contains from 5 to 85% by weight of polyisocyanates containing biuret, allophanate, urethane or isocyanurate groups, based on the total quantity of isocyanate present.

11. A process as claimed in claim 10 in which the polyisocyanate solution contains from 10 to 50% by weight of polyisocyanates which contain biuret, allophanate, urethane or isocyanurate groups.

12. A process as claimed in claim 10 or claim 11 in which the polyisocyanate solution is a solution of a biuret group containing polyisocyanate of the following general formula:

in which R represents an alkylene, cycloalkylene, aralkylene or arylene radical and X represents hydrogen or the group

- in which R has the meaning indicated above and n represents 0 or an integer, in a polyisocyanate which is free from biuret groups.
- 13. A process as claimed in claim 12 in which, in the general formula of claim 12, R represents a C₁ to C₁₀ alkylene, C₅ to C₁₀ cycloalkylene, C₇ to C₁₂ aralkylene or C₁ to C₁₂ arylene radical
- or C₆ to C₁₀ arylene radical.

 14. A process as claimed in claim 12 or claim 13 in which *n* represents 0 or an integer of from 1 to 5.
- 15. A process as claimed in any of claims 12 to 14 in which the proportion of biuret polyisocyanates which contain more than 3 isocyanate groups, based on the total quantity of polybiuret isocyanates is at least 20% by weight.
- 16. A process as claimed in any of claims 1 to 15 in which the polyisocyanate contains up to 20% by weight of monofunctional isocyanate.
- 17. A process as claimed in any of claims 1 to 16 in which the polyisocyanate contains from 0.3 to 5% by weight of chemically bound emulsifiers.
- 18. A process as claimed in claim 17 in which the polyisocyanate contains from 0.1 to 2% by weight of chemically bound emulsifiers.
- 19. A process as claimed in claim 17 or claim 18 in which the emulsifier contains —OH, amino, amido, —COOH, —SH or urethane groups and is incorporated in the polyisocyanate by reaction with the isocyanate groups.
- 20. A process as claimed in any of claims 1 to 19 in which the polyether has a molecular weight of between 750 and 10,000.
- 21. A process as claimed in any of claims 1 to 20 in which at least 10% of the hydroxyl groups of the polyether are primary hydroxyl groups.
- 22. A process as claimed in claim 20 or claim 21 in which the high molecular weight polyether is used in admixture with low molecular weight compounds which contain active hydrogen atoms.
- 23. A process as claimed in claim 22 in which the low molecular weight compound is a hydroxyl compound.
 - 24. A process as claimed in any of claims 1 to 21 in which the polyether is used in admixture with up to 50% by weightbased on the polyether, of other high molecular weight compounds which contain active hydrogen atoms.

| | 25. A process as claimed in claim 24 in which the polyether is mixed with a polyester, polyacetal, polyester amide or polycarbonate. | |
|----|--|-----|
| | 26. A process as claimed in any of claims 1 to 25 in which the foam resin is prepared by the one-shot process. | |
| 5 | 27. A process as claimed in any of claims 1 to 26 in which the reaction mixture contains a catalyst for the production of a form recip which can be contained by the catalyst for the production of a form recip which can be contained by the catalyst for the production of the catalyst for the catalyst | . 5 |
| 10 | 28. A process as claimed in claim 27 in which the catalyst is a tertiary amine and/or a silaamine, an N-substituted aziridine or a hexahydrotriazine, which may be used in combination with an organometallic compound. | |
| 10 | 29. A process as claimed in any of claims 1 to 28 in which the reaction mixture also contains an additive for regulating the cell structure, an inorganic or organic filler, a dye or a plasticiser. | 10 |
| 15 | 30. A process for the production of a flame-resistant foam-resin substantially as herein described with reference to any one of the Examples. | |
| כו | of claims 1 to 30. | 15 |
| | 32. A resin as claimed in claim 31 which is a cold hardening foam. | |
| | | |

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